

The Fresh-Water Fauna of the Protozoa in Antarctica

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Abstract: The materials examined in the study were obtained in the regions of Syowa Station of Japan, McMurdo Station of U. S. A. and Mirny Station of U. S. S. R. Ice-blocks of the materials, composed of mosses and algae, were collected from pools and wet beaches. The observations of unicellular animals have been carried out always in living condition.

From these samples have been found seven species of the Mastigophora including a single flagellate organism which is probably new to science, 13 forms of the Rhizopodea and 12 kinds of the Ciliata, and most of them are cosmopolitan. The Rhizopodea carrying a test, the so-called Testacea of common moss-dwellers, is the most excellent group in number of species. However, when ice-blocks were melted, *Amoeba* and several common species of the Ciliata were frequently found, and of them *Coleps* and *Verticilla* survived to the end when the samples were kept in room temperature for a long time.

Materials of the Study

The materials examined in the study were taken by Dr. T. MATSUDA from the regions of Syowa Station of Japan (1960–1961) and Mirny Station of U. S. S. R. (1965) on the coast of the Indian Ocean, and by Dr. H. FUKUSHIMA from

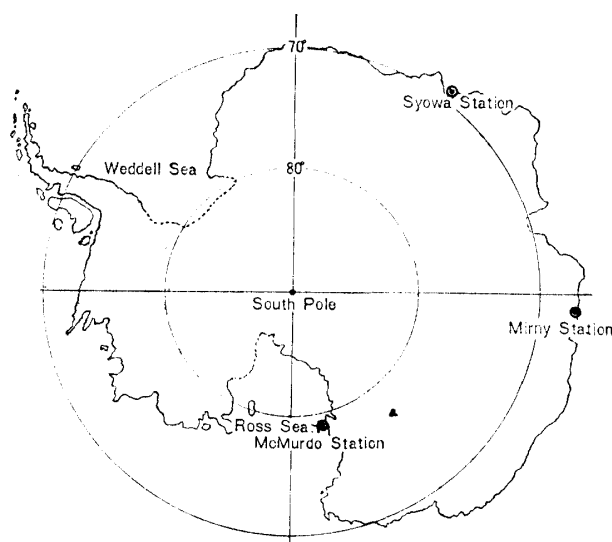


Fig. 1. Map of Antarctica showing the stations where collections were made.

the region of McMurdo Station of U. S. A. (1963) on the coast of the Ross Sea. These were composed of mosses which grow on sand beaches and rocks and fresh-water algae which are found in small streams and pools. The samples of minute organisms of Antarctica have been preserved in the icebox to keep them alive. Therefore, the observations of the animals were carried out always in living condition. The Rotatoria, Tardigrada, and Nematoda were also found in addition to the Protozoa.

I am very grateful to Dr. T. MATSUDA of the National Science Museum and to Dr. H. FUKUSHIMA of the Yokohama Municipal University for giving me the opportunity of studying the Protozoa of Antarctica.

Results of the Examination

From the above-mentioned materials have been obtained nine fresh-water species of the Mastigophora including two new ones, 14 forms of the Sarcodina comprising a single Heliozoa and 14 forms of the Ciliata, as listed in Table 1.

Of nine flagellated forms, the greenish flagellates having a chromatophore are only two, *Chrysococcus antarcticus* and *Chlamydomonas antarctica*, and the others are colorless species which usually occur in water containing much organic substance like sewage. In the present study it has become clear that common saprobic flagellates are also distributed in Antarctica as follows: *Heterochromulina* of the Chrysomonadida, *Astasia* and *Peranema* of the Euglenoida, and *Bodo* and *Cercomonas* of the free-living Kinetoplastida. These colorless flagellates rapidly increase in water of high temperature, however, colored forms peculiar to Antarctica disappear in such water.

The Sarcodina fauna consists of two kinds of naked amoeba, 11 forms of the Testacea and a single species of the Heliozoa. The worldwide amoeba, *Amoeba alveolata*, is common in the materials from all localities of Antarctica and reproduces in water of rather high temperature. The species of Genus *Trichamoeba* appear generally in marine and brackish water, therefore, *T. clava* seems to be brought to the land from the sea as in the case of some fresh-water diatoms of Antarctica.

The Testacea is principally divided into two groups, the Arcellinida and Gro-miida, by the shape of their pseudopodia. The species of the former are five and those of the latter six, and most of these are cosmopolitan and generally small in size, excepting *Centropyxis constricta* which is commonest in warmer regions of the world, while is very rare in the material of McMurdo Station. Among these amoeba carrying a test, *Planodifflugia lucida* and *Arcella artocrea* were found frequently in the collections from the regions of Syowa and McMurdo Stations, but living specimens of the common forms were always scarce. On the contrary, moving specimens of the small rare species, such as *Cochliopodium granulatam*, *Lep-tochlamys ampullacea* and *Microgromia elegantula*, often appear when examination was made.

One species of the Heliozoa, *Astrodisculus araneiformis*, has been observed only in the material from the region of McMurdo Station.

Table 1. List of the species of the Protozoa in Antarctica.

	Station			Japan
	Syowa	McMurdo	Mirny	
Subphylum Sarcomastigophora				
Superclass Mastigophora				
Class Chromonadea				
Order Chrysomonadida				
Suborder Euchrysomonadina				
1. <i>Heterochromulina termo</i> (Ehrenberg)	+	+	+	+
2. <i>Chrysococcus antarcticus</i> n. sp.	+	—	—	—
Order Dinoflagellida				
Suborder Diniferina				
3. <i>Gymnodinium fukushimai</i> n. sp.	—	+	—	—
Order Euglenoida				
Suborder Peranemina				
4. <i>Astasia inflata</i> Dujardin	—	—	+	—
5. <i>Peranema trichophora</i> (Ehrenberg)	+	—	—	+
Order Phytomonadida				
6. <i>Chlamydomonas antarcticus</i> Wille	+	+	—	—
Class Leucomonadea				
Order Kinetoplastida				
Suborder Bodonina				
7. <i>Bodo globosus</i> Stein	+	+	+	+
8. <i>Bodo edax</i> Klebs	+	+	+	+
9. <i>Cercomonas crasicauda</i> Lemmermann	+	—	—	+
Superclass Sarcodina				
Class Rhizopodea				
Subclass Lobossia				
Order Amoebida				
1. <i>Amoeba alveolata</i> Mereschkowsky	+	+	+	+
2. <i>Trichamoeba clava</i> Schaffer	+	+	—	—
Order Arcellinida				
3. <i>Cochliopodium granulatum</i> Penard	+	—	+	+
4. <i>Leptchlamys ampullacea</i> West	+	+	+	?
5. <i>Planodifflugia lucida</i> (Penard)	+	+	—	+
6. <i>Centropyxis constricta</i> (Ehrenberg)	—	+	—	+
7. <i>Arcella artocrea</i> Leidy	+	+	—	+
Subclass Filosia				

	Station			Japan
	Syowa	McMurdo	Mirny	
Order Gromiida				
8. <i>Euglypha laevis</i> Perty	+	—	+	+
9. <i>Asculina seminulum</i> (Ehrenberg)	+	—	+	+
10. <i>A. muscora</i> Greeff	+	—	+	+
11. <i>Corythion dubium</i> Taranek	+	—	+	+
12. <i>C. pulchellum</i> Penard	+	+	+	+
13. <i>Microgromia elegantula</i> Penard	+	—	+	+
Class Actinopodea				
Subclass ^s Heliozoia				
Order Centrohelida				
14. <i>Astrodisculus araneiformis</i> (Schewiako)	—	+	—	+
Subphylum Ciliophora				
Class Ciliatea				
Subclass Holotrichia				
Order Gymnostomatida				
1. <i>Spathidium lieberkühni</i> Bütschli	—	—	+	?
2. <i>Didinium balbianii</i> var. <i>anum</i> Kahl	+	—	+	+
3. <i>Prorodon teres</i> Ehrenberg	+	—	—	+
4. <i>Urotricha farcta</i> Cl. & L.	+	+	+	+
Order Trichostomatida				
5. <i>Colpoda cuculla</i> Müller	+	+	+	+
Order Hymenostmatida				
6. <i>Glaucoma scintillans</i> Ehrenberg	+	+	+	+
Order Perichida				
7. <i>Epistylis</i> sp.	+	—	+	+
8. <i>Vorticella microstoma</i> Ehrenberg	+	+	+	+
9. <i>V. pusilla</i> Stokes	+	—	—	?
Subclass Spirotrichia				
Order Oligotrichia				
10. <i>Strombolidium gyrans</i> Stokes	+	+	—	+
Order Hypotrichia				
11. <i>Uroleptus gibbus</i> (Cl. & L.)	+	—	—	?
12. <i>U. musculus</i> Ehrenberg	—	+	—	?
13. <i>Holosticha intermedia</i> (Bergh)	+	—	+	?
14. <i>H. vernalis</i> Stokes	—	+	—	?

In 14 forms of the Ciliata are included many cosmopolitan species common in sewage, such as *Urotricha farcta*, *Colpoda cuculla*, *Glaucoma scintillans* and *Strombilidium gyrans*. Their quick division is sometimes observed under a coverglass during the examination, when water temperature rises according to room temperature. Whenever the Ciliata increases, motile aerobic bacteria, *Pseudomonas*, *Vibrio* and *Spirillum* are abundant.

In the materials brought from the region of Syowa Station 30 fresh water species of the Protozoa have been observed and in those from McMurdo and Mirny Stations 20 and 21 forms have been detected respectively. The greater number of species at Syowa Station is due to sufficient materials comparing those of the other stations. The following cosmopolitan species occur in the three regions of Antarctica: *Heterochromulina termo*, *Bodo globosus*, *B. edax*, *Amoeba alveolata*, *Leptochlamys ampullacea*, *Corythion pulchellum*, *Urotricha farcta*, *Colpoda cuculla*, *Glaucoma scintillans* and *Vorticella microstoma*, which are able to live in waters of high temperature and even in polluted water, excepting the Testacea which are usual moss-dwellers.

Common species of the Protozoa between Syowa and McMurdo Stations, Syowa and Mirny Stations, and McMurdo and Mirny Stations are respectively 15, 19 and 10. Excluding two, *Astasia inflata* and *Spathidium lieberkühni*, the forms of Mirny Station are the same as those of Syowa Station. This fact seems to suggest that these stations are similar in geographical and meteorological conditions. The species of McMurdo Station common with those of the other stations are fewer and most of them are cosmopolitan. The fauna of the Protozoa of this station is distinctly different from that of the others in containing of a colorless dinoflagellate, *Gymnodinium fukushimai*, a small form of the Heliozoa, *Astrodisculus araneiformis*, and a common species of the Testacea in temperate regions, *Centropyxis constricta*. Distribution of these warm water species is probably indicates that the region of McMurdo Station is more or less warmer than the Syowa and Mirny regions.

Descriptions of the New Species

Chrysococcus antarcticus n. sp. (Fig. 2)

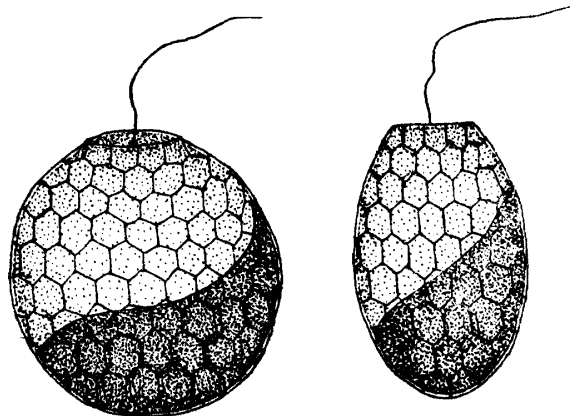


Fig. 2. *Chrysococcus antarcticus*, n. sp. $\times 1,000$.

The new species has a transparent thin cuticular shell ornamented with a rather rough reticulation. The shell, spherical in side view, is more or less compressed, and is provided with a comparatively large opening from which a short flagellum stretches forward. A single large light green chromatophore is situated on the posterior side of the cell. A flagellum is shorter than the cell having no stigma.

Length, 30–32 μ ; breadth, 30 μ ; thickness, 20 μ ; apertural opening, 7–9 μ .

The new species is different from the published forms in entire attachment of the cell to the compressed shell with a wide opening, and in having a single large chromatophore and a short flagellum. The Antarctic form has been rarely detected in the material obtained from the largest pool in the East Ongul Island of Syowa Station. Species of this genus have not been found in Japan. Therefore, a detailed comparative study is impossible in the present examination.

Gymnodinium fukushimai n. sp. (Fig. 3)

The minute naked dinoflagellate is colorless due to absence of chromatophores. The body having several drops is oblong and slightly compressed dorso-ventrally. The nucleus is ovoid and rather large. The girdle and sulcus are wide and nearly straight, and the longitudinal flagellum is twice as long as the body.

Length, 7 μ ; breadth, 5 μ .

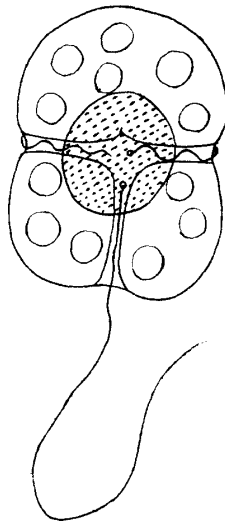


Fig. 3. *Gymnodinium fukushimai*, n. sp. $\times 5,000$.

A few forms of Genus *Gymnodinium* containing no chromatophore have been reported from Europe, North America and Australia, but no specimen has been found in Japan. The new species was scarcely detected in the materials taken from McMurdo Station. It is somewhat similar to *G. lantzschii* Utermoehl in size and shape, but is distinguishable from the latter in remarkably minute size and in having a rounded anterior end and a truncated posterior one.

Summary

1. From the three regions of Syowa, McMurdo and Mirny Stations in Antarctica have been detected nine fresh-water species of the Mastigophora, 14 forms of the Sarcodina and 14 of the Ciliata.
2. In all fresh-water forms of the Protozoa 37 in number, are included two new species of the Mastigophora, *Chrysococcus antarcticus* and *Gymnodinium fukushimai*.
3. About one-third of these are cosmopolitan species of worldwide distribution.
4. It seems that the regions of Syowa and Mirny Stations are similar in factors of the biological environment, judging from many common species between the two stations.
5. Occurrence of warm water species of the Protozoa tells that the region of McMurdo Station is most favorable in temperature for living organisms among three stations of Antarctica where the materials of the present study were obtained.

Reference

- HADA, Y.: The Fresh-water fauna of the Protozoa in the region of the Syowa Station in Antarctica (in Japanese with English résumé). Bull. Suzugamine Women's Coll., Nat. Sci., **11**, 5-21, 1964.